REMARKS/ARGUMENTS

Reexamination of the captioned application is respectfully requested.

A. SELECTED COMMENTS REGARDING THE DISCLOSURE

The technology disclosed in the specification concerns, e.g., a bipolar semiconductor device which includes: (1) a substrate in which a surface having a specified off-angle from a (000-1) carbon surface of a crystal of a first-conductive-type silicon carbide semiconductor whose base material is silicon carbide, which is a compound of carbon and silicon, is formed; and (2) at least one drift layer which is formed on a crystal growth surface of the substrate at a specified formation rate with a first- or second-conductive-type silicon carbide semiconductor, where the surface of the substrate having the specified off-angle is taken as the crystal growth surface of the substrate.

Various embodiments are described, including (1) a pn junction diode of Fig. 1 (see paragraphs [0046] -[0070] of the specification); (2) an NPN bipolar transistor of Fig. 4 (see paragraphs [0071] -[0093] of the specification); and (3) an Insulated gate bipolar Transistor (IGBT) of Fig. 5 (see paragraphs [0094] -[0114] of the specification).

The off-angle is within a range of 2 to 10 degrees and the film that is to serve as a drift layer and that is formed by epitaxial growth of silicon carbide is formed at a film growth rate having a film-thickness increasing rate per hour of 10 μm/h or more.

B. THE PRIOR ART REJECTIONS

Claims 13-15, 19 and 20 stand rejected under 35 USC 102(b) as being anticipated by EP 1,215,730 to Shiomi et al in view of U.S. Patent 6,995,396 to Takahashi et al[1].

The March 13, 2009 non-final office action correctly admits that EP 1,215,730 to Shiomi does not specifically disclose an off angle in the claimed range of 2 to 10 degrees. See the second full paragraph on page 4 of the March 13, 2009 non-final office action.

However, this second office action alleges that U.S. Patent Publication US 2003/0080384 to Takahashi discloses an off-angle within a range of 0 to 10 degrees from the (000-1) carbon surface. The office action notes that the range of 0 to 10 degrees supposedly taught by U.S. Patent Publication US 2003/0080384 to Takahashi overlaps the claimed range of 2 to 10 degrees. The office action further opines that it would be obvious to modify the off angle of EP 1,215,730 to Shiomi with the (0 to 10 degrees) off angle of U.S. Patent Publication US 2003/0080384 to Takahashi first for the purpose of suppressing macro steps applicable to growth of a material other than SiC and improving fabrication efficiency. See, e.g., third and fourth paragraphs on page 4 of the March 13, 2009 non-final office action.

C. PATENTABILITY OF THE CLAIMS

All prior art rejections are respectfully traversed for at least the following reasons.

The March 13, 2009 non-final office action again applies Shiomi and reiterates earlier allegations against claim 13. Applicants accept the concession of the office action that the claimed off-angle range is not taught EP 1,215,730 to Shiomi et al. Applicants

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[1] There are other Takahashi references of record, such as US Patent 5,958,132. However, applicants believe that the particular paragraphs mentioned on page 4 of the office action indicate that U.S. Patent Publication US 2003/0080384 to Takahashi forms the basis of the rejection. Moreover, U.S. Patent Publication US 2003/0080384 to Takahashi is listed on the PTO-892 which is attached to the March 13, 2009 non-final office action.

also request that the Office recognize that there are structural differences between the subject matter of the claims and the Shiomi structure which militate against the alleged combination. For example, the lattice orientation (Miller index) of silicon carbine crystal surface (2a) being at an off-angle of $2 - 10^0$ from the (000-1)C surface 2, on which the drift layer is formed, can be detected by an X-ray scattering technique. Further, as described in Shiomi ¶ [0017], the orientation of the growth surface affects characteristics and properties of the crystal due to the micro-pipes and screw dislocations generated during the growth. Thus, the difference in orientation of the crystal growth surface can be distinguished.

Applicants emphasized that the drift layer (23) of claim 13 is formed on a substrate surface (2a) having a specified off-angle (θ) from a (000-1) carbon surface (2), as clearly shown in Fig. 2 and described in paragraphs [0044] and [0046]. In contrast to this, Shiomi's buffer layer 4 and active layer 6 are formed on 4H-SiC {03-38} surface or a surface having an off angle α from {03-38} surface (col. 3, line 65 - col. 4, line 6) of substrate 2 forming an angle of 54.74° relative to (000-1) carbon surface, as is clearly shown in Fig. 2 and described at col. 5, lines 22-55. This is a conclusive difference between claim 13 and Shiomi's reference. In Shiomi's SiC wafer 1, 4H-SiC (000-1) plane is used only for growing an ingot by modified Rayleigh process before slicing the ingot into {03-38} plane and thus not for growing the buffer layer 6 and the active layer 6 (col.5, lines 23-24).

Shiomi describes as a comparative example in which the active layer is grown on the 4H-SiC (1-100) plane and a plane 8 degree off the (0001) plane at col. 8, line 65 col. 9, line 2. However, these planes are also conclusively different from (000-1) plane claimed in claim 13 and moreover the semiconductor devices have drawbacks as described at col. 10, lines 25-3 1 and lines 43-50.

The reference surfaces *per se* for the off-angles of applicants' claims and Shiom are (000-1) plane and {03-38} plane, respectively, and thus conclusively different.

As to newly cited reference of Takahashi, claim 4 and paragraph [0031] thereof describes that "a top face of said SiC bulk substrate is selected from the group consisting of an offcut plane with an off angle of 0 through 10 degrees of the β-SiC (111) plane, the α-SiC (0001) plane of 6H-SiC or 4H-SiC, or the Si plane of 15R-SiC, and an offcut plane with an off angle of 0 through 15 degrees of the β-SiC (100) plane, the β-SiC (110) plane, the α-SiC (1-100) plane of 6H-SiC or 4H-SiC, or the α-SiC (11-20) plane".

From the foregoing quotation/citation it is clear that Takahashi uses (0001) Si surface, (1-100) surface and (11-20) surface and does *not* use the claimed (000-1) surface.

The expression "the (0001) plane (namely, c-plane)" appears in paragraph [0221] of Takahashi. However, the lowercase "c" has nothing to do with the uppercase "C" surface described at paragraph [0071] and shown in Applicants' Fig. 6 which is 4H-SiC substrate surface 2a having off-angle θ of 8 degrees from the (000-1) carbon surface 2. Because, the "c"-plane of Takahashi derives from the conventional way of naming in the relevant technical field that the direction <0001> is designated in terms of lattice constant as "c".

Applicants see nothing in the paragraphs of Takahashi mentioned in the office action that constitutes a disclosure or even a suggestion that the (000-1) plane of substrate is used for growing such a semiconductor layer as the drift layer in claim 13. The office action seems to list these paragraphs by sheer speculation. Applicants fail to see any basis in Takahashi for an obviousness rejection.

D. **MISCELLANEOUS**

In view of the foregoing and other considerations, all claims are deemed in condition for allowance. A formal indication of allowability is earnestly requested.

The Commissioner is authorized to charge the undersigned's deposit account #14-1140 in whatever amount is necessary for entry of these papers and the continued pendency of the captioned application.

Should the Examiner feel that an interview with the undersigned would facilitate allowance of this application, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

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